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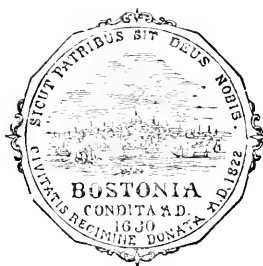


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City Document.—No. 20.

CITY OF BOSTON.



ANNUAL REPORT

OF THE

CITY ENGINEER,

FOR THE YEAR

1873.

CITY OF BOSTON.

OFFICE OF CITY ENGINEER, CITY HALL,
BOSTON, Jan. 26th, 1874.

TO THE HONORABLE CITY COUNCIL :—

The following report of the expenses and operations of this department, during the year 1873, is submitted in compliance with the sixth section of the ordinance relating to the City Engineer's Department.

Statement of expenses paid from the department appropriation :—

Amount of appropriation for 1872-73,		
expended from January to May, 1873	.	\$6,068 86
Amount of appropriation for 1873-74	.	24,000 00
		<hr/>
		\$30,068 86

Salaries of City Engineer, assistants,		
draughtsmen and rodmen	.	\$20,431 83
Instruments and repairs of same	.	244 50
Drawing paper and materials	.	630 07
Stationery, printing stock, etc.	.	326 52
Reference books and map frames	.	140 75
Printing and advertising	.	18 21
Horse	.	350 00
Travelling expenses, horse-keeping,		
etc.	.	655 52
Incidental expenses	.	260 73
		<hr/>
		23,058 13
Unexpended balance Jan. 1, 1874	.	\$7,010 73

The following statement shows the amounts paid for engineering from special appropriations since Jan. 1, 1873 :—

WATER WORKS.

New water supply, pay-rolls and	
incidentals	\$169 57
Water works (Wards 13-16).	85 75
Parker-hill reservoir	1,741 15
	<hr/>
	\$1,996 47

WIDENING STREETS.

Eastern-avenue bridge : incidental expenses	31 15
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CHELSEA-STREET BRIDGE.

Pay-rolls and incidentals	414 50
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FEDERAL-STREET BRIDGE.

Pay-rolls and incidentals	105 50
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WEST BOSTON AND CANAL BRIDGES.

Pay-rolls and incidentals (one-half of this amount was paid by the city of Cambridge)	226 25
	<hr/>

Total from special appropriations	2,773 87
Add amount paid from the department appro- priation	23,058 13
	<hr/>

Total engineering expense for 1873	\$25,832 00
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The number of persons employed and paid from the department appropriation was, on the first of January, 1873 (including the City Engineer), 16. The present number is 19.

The engineering force engaged upon the work pertaining to "additional supply" is paid by the Water Board, and

although under the immediate direction of the City Engineer, is distinct from the force of this department.

The large amount of work required by the great number and magnitude of projected improvements, and the largely increased territory to be covered, due to annexation, will undoubtedly necessitate the forming of new parties, and a consequent addition to the number of employes during the coming year.

The following statement gives the operations of the department for the past year, together with such description of works, finished or in progress, as is thought to be of general interest.

WATER WORKS.

Sudbury River and Lake Cochituate. — No water has been drawn from the Sudbury river during the past year. On Jan. 1st, 1873, the water in Lake Cochituate stood at twelve feet one inch above the bottom of the conduit. At the beginning of the previous year there was no water in store, the conduit being then supplied by pumping from a level below its flow line.

To maintain the supply, about 1,676,600,000 gallons were turned into the lake from Sudbury river; this, combined with the copious rains of the latter part of the year, brought the water level within about 15 inches of high-water mark at the beginning of 1873. From this date it rose gradually till Jan. 17th, when waste over the dam commenced and continued till April 23d, the water then standing at 12 feet 11½ inches.

On May 4th the stop planks were again removed and the water allowed to waste till May 20th. From this time till Aug. 14th the water gradually fell, and at the latter date stood at 8 feet 7 inches; on Aug. 27th it stood at 8 feet 9½ inches; Sept. 4th, 6 feet 8½ inches; Oct. 10th, 7 feet 6 inches; Oct. 19th, 7 feet 3 inches; and on Dec. 31st, 9 feet 9 inches.

To secure a flow that will supply the city with the rate of consumption of the past year, there are required from 6 to $7\frac{1}{2}$ feet of water above the bottom of the conduit, and, as in September there were less than 7 feet, fears were entertained that a resort to pumping would again be required, but fortunately heavy rains furnished the needed relief.

The total waste over the dam for the year has been 2,917,977,000 gallons, equal to an average daily supply of 7,994,460 gallons. Had there been no aid from the Sudbury river the previous year, the waste in 1873 would have been equal to an average daily supply of about 3,400,000 gallons. This waste is due to the want of storage room, yet that afforded by the Cochituate lake is much greater in proportion to its drainage area than it is usually possible to secure for the water sources of this portion of the country, and in fact is more than sufficient to make available all the water that can be collected in a season of extreme drought.

Conduit. — On Nov. 19th and 20th a thorough examination of the interior of the conduit was made by Mr. Wiggin, clerk of the Water Board, and others, who passed through its entire length from the lake to Chestnut Hill reservoir.

A number of new and dangerous cracks were discovered; those on the embankment to the west of Charles river were of such alarming character that it was considered imperative they should be repaired at once; accordingly the water was kept shut off and a force of masons kept at work night and day until temporary security was ensured.

At this point there was found a crack in the bottom varying in width from $\frac{1}{2}$ to $1\frac{1}{2}$ inch and 200 feet long, through which an iron rod readily passed and penetrated the gravel filling below. The leakage here must have been considerable, but it did not make its appearance at the surface of the bank, owing to the very porous nature of the material forming it.

The repairs made in no way add to the strength of the conduit; the best that could be done was to stop the leakage

and thus remove for a while the danger of undermining the masonry.

Consumption. — The average daily consumption for each month of 1873 has been as follows: —

January	.	.	.	.	.	17,639,100	gallons.
February	.	.	.	.	.	18,461,000	“
March	.	.	.	.	.	15,983,700	“
April	.	.	.	.	.	14,781,800	“
May	.	.	.	.	.	17,637,400	“
June	.	.	.	.	.	20,100,600	“
July	.	.	.	.	.	20,917,100	“
August	.	.	.	.	.	19,544,600	“
September	.	.	.	.	.	19,572,700	“
October	.	.	.	.	.	17,113,800	“
November	.	.	.	.	.	16,633,400	“
December	.	.	.	.	.	15,727,100	“

The average for the year is 17,842,700 gallons, — an increase of 2,779,300 gallons, or $18\frac{1}{2}$ per cent. above that for 1872.

On July 20 observations were made at the Beacon Hill reservoir, to determine the rate of night consumption, or more properly speaking, the rate of *waste*, in a certain district of the city.

This district comprises what is called the west end, north end and burnt district, and contains not far from 80,000 inhabitants. In it are located many of the manufacturing houses, principal hotels, newspaper offices, printing-houses, etc., of the city, but at the time selected for the experiment, between twelve and three o'clock, Sunday morning, the legitimate use of water must have been very small.

This section was shut off from all communication with the Brookline and Chestnut Hill reservoirs, by gates on Bedford, Washington, Tremont, Charles and other streets, and fed exclusively from the Beacon Hill reservoir. The leakage through the gates, if any, must have been inappreciable,

as the pressures on opposite sides could have differed but slightly.

Observations were commenced at midnight, and readings of the gauge taken every fifteen minutes. At the first of the experiment the consumption was found to be somewhat irregular, but between one and three o'clock it was remarkably uniform, showing that the draft was not due to irregular opening and shutting of cocks, but to a continuous flow at almost unvarying outlets.

There were drawn from the reservoir during these two hours, 386,857 gallons, equal to a rate of 4,642.284 gallons in 24 hours. This enormous rate of night consumption indicated either a heavy leakage or great waste. A party of inspectors was at once organized, under the direction of Mr. Joseph Whitney, of Cambridge, who from experience gained in searching for leaks on the Cambridge works, was particularly qualified for this work, and a careful inspection of all the fittings in the district was made, and the street mains were tested for leaks in various ways. No leaks were discovered in the mains, but many hundreds of defective fittings were found and repaired, and some leaks in the house service-pipes detected and stopped. Before the examination was concluded, however, it became manifest that much the greater portion of the night consumption was caused by waste, that is, by flow through fittings left open either carelessly or wilfully. All the leaks that could be discovered having been stopped, a second observation was made on Sunday morning, October 5, between the hours of twelve and three, as before. The water in the reservoir at the commencement of the trial stood at the same height as on the morning of July 20.

There was a slight wind blowing at the time of the latter trial, which caused an oscillation in the gauge-tube, and the readings were not so satisfactory as those of July. During the three hours of observation the water fell 2 feet $4\frac{5}{8}$ inches, showing a consumption of 506,182 gallons, which is at the

rate of 4,049,456 gallons in 24 hours. The consumption between one and three o'clock was 336,294 gallons, or at the rate of 4,035,528 gallons in 24 hours, showing a small saving, about 13 per cent., caused by the repairs made.

The greater portion of the remainder of the consumption must have been caused by waste.

RESERVOIRS.

Although during the summer the conduit was used under a pressure greater than was deemed safe, yet it was found impossible to maintain the level of the reservoirs at a greater height than within four or five feet of high-water mark.

The Beacon Hill, South Boston and East Boston reservoirs, though kept partially filled with water, to be used in case of necessity, have been kept shut off from the distributing system of pipes for the past year.

HIGH-SERVICE.

Parker Hill Reservoir. — On March 4, a report upon various methods of increasing the effective capacity of the high-service system of supply was made to the Water Board, and the building of a reservoir, with a capacity of about 7,000,000 gallons, upon Parker Hill, in the Highland District, was recommended.

An act of the Legislature granting the right to take lands for the purpose of building this reservoir was obtained May 14, 1873, and an appropriation of \$161,000 was passed by the City Council, June 6, 1873.

Contract and specifications were drawn up and proposals for doing the work, to be received till July 29, were advertised for. Three bids were received, of which that of Stephen H. Tarbell and Martin Hayes, both of Boston, was the successful one, being the lowest. The contract was awarded July 30, and the work on the ground commenced

August 11, and continued till frost interfered. About 20,000 cubic yards of earth have been excavated, and 600 cubic yards of stone collected.

The payments under this contract have been as follows : —

Estimate to September 20 . . .	\$4,613 32	
Less 15 per cent. . . .	692 00	
	<hr/>	
Amount paid . . . .	.	\$3,921 32
Estimate to October 20 . . .	\$8,818 90	
Less 15 per cent. . . .	1,322 83	
	<hr/>	
	\$7,496 07	
Less previous payment . . .	3,921 32	
	<hr/>	
Amount paid . . . .	.	\$3,574 75
Estimate to November 20 . . .	\$11,650 46	
Less 15 per cent. . . .	1,747 57	
	<hr/>	
	\$9,902 89	
Less previous payments . . .	7,496 07	
	<hr/>	
Amount paid . . . .	.	\$2,406 82
	<hr/>	
Total amount paid to date . . . .	.	\$9,902 89

The preliminary surveys and estimates of quantities for this work were made by Ass't W. F. Learned and party, and the work of construction is done under his direction. It is expected that the reservoir will be ready for service early next fall. Its purpose will be found fully stated in the report of the Water Board, May, 1873.

PUMPS.

The high-service engines have continued to work well during the year, and though in the morning hours they have been run at a high speed no failure has occurred. The

average daily amounts pumped during each month of the year have been as follows : —

January	1,027,102 gallons.
February	1,078,692 “
March	1,004,701 “
April	979,099 “
May	939,431 “
June	1,059,176 “
July	1,049,775 “
August	949,938 “
September	1,061,706 “
October	1,059,964 “
November	1,013,751 “
December	1,062,920 “

DISTRIBUTING SYSTEM.

Considerable work has been done during the past year in extending the street pipes, more particularly in the Highland and Dorchester Districts, and important changes have been made in the old system of distribution, especially in the city proper. Many of these changes were recommended in the last annual report of the City Engineer to the Water Board, others have been marked out in special reports made in response to orders of the City Council or of the Water Board, and others still have been suggested by the experience of an inadequate supply at certain points, either for fire or other purposes.

Although much has been done already in this direction, more remains to be done. There has lately been let, under authority from the City Council, a contract for about 3,500 tons of pipes, to be used in replacing old pipes by new ones of much larger calibre. These will be chiefly used as sub-mains and feeders, and all the hydrants removed in laying them will be replaced by those of the Lowry pattern. Lowry hydrants have been in use from the first in the Highland and

Dorchester Districts, and lately have been set in the "burnt district" and at other points in the city proper, and it is probable that in the future they will be almost exclusively used, since they meet the approval of the Fire Department.

Early in the season plans and estimates were made for re-piping the "burnt district," and an appropriation of \$85,000 for this purpose was made by the City Council. This work is now nearly finished. A large number of the streets in this district were re-piped with 12 and 8-inch pipes in place of 6-inch, and the plan requires all the old tuberculated pipes to be taken up, to make room for new pipes coated with coal-tar.

The new system has a capacity of delivery several times greater than the old, even if, for the latter, no deduction for tuberculation be made, and is provided with Lowry hydrants placed at distances apart never exceeding 260 feet, and generally falling much below this. In place of 80 of the old 3-inch hydrants, 113 Lowry hydrants with 9-inch barrels have been or will be substituted. The former accommodated but one steamer, the latter will accommodate four; hence it will be seen the facilities for extinguishing fires have been very largely increased. The changes made have given an improved head or pressure throughout the district.

The following are some of the more important improvements that have been made in the system of other parts of the city : —

A 16-inch pipe has been laid from the 30-inch main on the Common, through Joy street to Mt. Vernon, there connecting with the Beacon Hill high-service system.

This change releases the 30-inch main over the hill for use on the low-service, and this main now forms an important connection of the large mains from the Brookline reservoir with the sub-mains and feeders of the northern part of the city, and very greatly increases the pressure and supply for fire purposes in the northern wards.

On Central wharf 2,800 feet of 8-inch pipe have been laid in place of 4-inch, and 11 Lowry hydrants set.

On Lewis wharf 6 and 8-inch pipes have been laid in place of 4-inch, and 4 Lowry hydrants set.

In Washington street, between Bedford and Essex streets, 800 feet of 12-inch pipe have been laid in place of 6-inch, and 5 Lowry hydrants set.

In Essex street, between Washington and Oxford streets, 500 feet of 8-inch pipe have been laid in place of 6-inch, and 2 Lowry hydrants set.

In Norfolk place 8-inch pipe has been substituted for 4-inch, and 1 Lowry hydrant set.

For the protection of City Hall and property in the vicinity, a Lowry hydrant has been set on School street and an 8-inch pipe laid from the 12-inch sub-main of School street to the rear portion of Court square, where two new Lowry hydrants are located.

For the special protection of the Registry of Deeds and Probate building, two Lowry hydrants have been set on Tremont street.

In New Devonshire street an 8-inch pipe has been laid and three Lowry hydrants set.

In Charles street, between Pinckney and Cambridge, and between Leverett and Poplar, 16-inch pipe has been laid in place of 6-inch (in all 1,430 feet), and seven Lowry hydrants set.

In Columbus avenue 764 feet of 12-inch pipe have been laid, and two Lowry hydrants set.

In Berkeley street 600 feet of 8-inch pipe have been laid, and two Lowry hydrants set.

In Clarendon street 690 feet of 12-inch pipe have been substituted for 6-inch.

Lowry hydrants have been set at other points in different parts of the city proper, making sixty in all, exclusive of those in the burnt district.

A report was also made, by order of the City Government, upon the cost and expediency of building street reservoirs, and the Water Board was subsequently authorized to build these reservoirs at such points as should be selected by it and the Fire Department.

In July, plans were prepared for a syphon at the Dover-street draw, for the South Boston high-service main. The pipes for this work were not received till late in the fall. The syphon was successfully lowered into its place Dec. 24. It consists of a strong box made of 12 by 14-inch hard-pine timber, well bolted together and held by iron straps, and knee timbers at the angles (where the horizontal portion joins the vertical arms), in which is laid a 16-inch water-pipe, the space between the box and pipe being filled solid with concrete. The syphon box is 48 feet in length, with vertical arms of $28\frac{1}{2}$ and $25\frac{2}{3}$ feet in height, and the grade of the bottom of the box is 17 feet below mean low water.

PIPE PLANS, ETC.

A large amount of work has been done during the past year in the preparation of plans showing the sizes, location, etc., of pipes, hydrants, and other appurtenances to the street system of distribution, as is shown by the following extracts from the report of Assistant Dexter Brackett: "A large portion of my time has been spent in preparing plans to show more fully the pipe distribution of the city, and under this head the following has been accomplished." "The sectional plans of Boston and the Highland District, spoken of in my last report, have been finished, together with a duplicate set of those of the Highland District, for the use of the Cechituate Water Board."

"Early in the year, sectional plans of Dorchester, thirty-four in number, similar to those of the Highland District, showing, on a scale of 100 feet to an inch, the location of the water-pipes, gates and hydrants were commenced, and these

with duplicates of the same for the Water Board are practically completed.

"A plan is now in progress which will show, on one sheet, sixty by seventy-two inches, the entire pipe system of the City proper, South Boston, and Roxbury Highlands, with a portion of Dorchester.

"When the system is extended through the recently annexed territory, a similar plan will be required for West Roxbury and the remaining portion of Dorchester.

"During the year plans of the City proper, South and East Boston have been made, showing the changes proposed, with estimates of the lengths of pipe required to make the system more effective; others, showing the pipes as re-laid in the burnt district, and the plans belonging to the Water Board and the Superintendent of the Eastern Division, which, together with our own, number 160, have been corrected as the system has been extended.

"Sectional plans in duplicate, showing the property owned by the city on the line of the Cochituate Aqueduct and the lots which have from time to time been sold therefrom, are in preparation, and will be completed early in the year."

A set of finished drawings, showing the gate-houses and other structures at the Chestnut-Hill reservoir, as they were actually built, has been commenced, and is in a forward state of completion.

ADDITIONAL SUPPLY.

A report bearing date Jan. 27, 1873, together with plans and estimates relating to the various sources within fifty miles of the city, available for the supply of Boston, and giving in detail the proposed scheme of works for a supply from the Sudbury river, was presented to the Water Board in that month.

This report, together with one from Mr. Chesbrough, City Engineer of Chicago, and another from the Water Board

upon the same subject, was presented to the City Council early in the year.

The plan proposed received the approval of the City Government, and an appropriation of \$500,000 was made to cover the estimated expenses of the past year.

A number of engineering assistants were engaged early in May, and placed under the direction of Mr. A. Fteley, who was appointed Resident Engineer in charge of the whole work, and the final location of the conduit line, dams, etc., and plans of structures, and forms of contracts and specifications were commenced.

The line is now located, and cross sections of the ground have been taken, and a large number of plans, profiles, etc., have been prepared.

A contract, amounting to about \$340,000, for excavating a tunnel and building a portion of the conduit, was let early in August, and considerable work has been done under it.

Other portions of the work were made ready for contract, and advertisements for proposals would have been made last fall, had not the action of the City Council rendered such course unwarrantable.

In October surveys and plans of certain lands in the valley of the Sudbury were made, for the purpose of preparing papers for the taking of such lands. It was, however, decided by the City Solicitor that the City Council had not authorized the Water Board to take lands or water-rights; and accordingly the Board made application, October 20, for the needful authority.

Charlestown, with its water supply, had recently been annexed by vote of the people, and the strong argument urged in favor of annexation had been the use of the Mystic water for the partial supply of Boston, and the consequent postponement for a number of years of the large expenditure required for the building of the Sudbury river works, as projected. Under the circumstances, it was thought best by the

City Council, before granting the power asked for, to have made a more thorough investigation of the capacity and purity of the water of the Mystic valley, and accordingly an order was passed requiring the Water Board to enter into further examination on these points. For this purpose the Board engaged the services of Mr. J. P. Kirkwood, of Brooklyn, Mr. J. B. Francis, of Lowell, and Professor E. N. Horsford, of Cambridge. The studies have been completed, the reports made, and the results will soon be laid before the City Council.

FARM POND.

During the month of February, Mr. Brackett, of this office, made a survey, with soundings, of Farm Pond, in Framingham, and prepared a plan, on a scale of 100 feet to an inch, showing the soundings and nature of the bottom, and giving contour lines for each foot in depth.

BRIDGES.

The 5th section of the ordinance relating to City Engineer's department, reads as follows : —

"Said Engineer shall make annually, or oftener, if required, a careful examination of all the bridges within the city limits, and make such reports respecting their condition as to safety, need of renewal, or repairs, as the exigency of the case may require."

This, I have assumed, directs that an examination of all bridges within the city limits, that are open to street travel, (whether supported by the city or other corporation), and the foot-bridges in public grounds, shall be made annually, or oftener, under the direction of the City Engineer; accordingly I have caused as complete a survey of such bridges as this

department has the means and authority to make, to be made from time to time by Mr. Manley, the assistant in charge of bridges, and in addition Mr. Wightman, Assistant City Engineer, and myself, have given them such attention as our other duties would permit.

During the year several written reports upon the condition of various bridges, and a number of estimates of cost of repairs, etc., have been made by Mr. Manley, and copies, with such remarks and recommendations as each case required, have been transmitted to the Committee on Bridges, or to the Superintendent of Streets.

These reports will be found in the Appendix.

The following is a list of the bridges which, by the foregoing interpretation of the ordinance, come under the inspection of this department.

Those marked with an asterisk are over navigable waters, and are each furnished with a draw. Those in italics have been heretofore in part, but hereafter will be entirely, supported by the city; those in small capitals have come under the control of the city through the annexations of this year.

1ST. — BRIDGES WHOLLY SUPPORTED BY THE CITY.

* Albany street, over Roxbury canal.

Ashland street, Ward 17, over Boston and Providence Railroad.

Berkeley street, over Boston and Albany Railroad.

Berkeley street, over Boston and Providence Railroad.

* Broadway, over Fort Point Channel.

Brookline avenue, over Muddy river, Ward 15.

* *Charles River*, from Boston to Charlestown.

* Chelsea street, from East Boston to Chelsea.

Columbus avenue, over Boston and Albany Railroad.

* Commercial point, or Tenem, Ward 16.

Dartmouth street, over Boston and Albany and Boston and Providence Railroads.

Dorchester street, over Old Colony Railroad.

- * Dover street, over Fort Point Channel.
- * Federal street, over Fort Point Channel.
- Ferdinand street, over Boston and Albany Railroad.
- Huntington avenue, over Boston and Albany Railroad.
- * Meridian street, from East Boston to Chelsea.
- Milldam, over Back Bay sluices.
- * Mt. Washington avenue, over Fort Point Channel.
- Newton street, over Boston and Providence Railroad.
- Public Garden foot bridge.
- Shawmut avenue, over Boston and Albany Railroad.
- * *Warren bridge*, from Boston to Charlestown.
- Winthrop bridge, from Breed's island to Winthrop.

2D. — BRIDGES OF WHICH BOSTON SUPPORTS THE PART
WITHIN ITS LIMITS.

- * CAMBRIDGE STREET, from Brighton (Ward 19), to Cambridge.
- * CHELSEA BRIDGE, from Charlestown to Chelsea.
- * Granite bridge, from Dorchester (Ward 16) to Milton.
- Longwood avenue, from Ward 15 to Brookline.
- Mattapan, from Ward 16 to Milton.
- Milton “ “ “ “ “
- * Neponset, from Ward 16 to Quincy.
- * NORTH BEACON STREET, from Ward 19 to Watertown.
- * NORTH HARVARD STREET “ “ “ “ Cambridge.
- SPRING STREET, from West Roxbury (Ward 17) to Dedham.
- * WESTERN AVENUE, from Ward 19 to Cambridge.
- * WESTERN AVENUE “ “ “ “ Watertown.

3D. — BRIDGES OF WHICH BOSTON PAYS A PART OF THE
COST OF MAINTENANCE.

- Albany street, over Boston and Albany Railroad.
- * Canal bridge, from Boston to Cambridge.

- * MALDEN BRIDGE, from Charlestown to Everett.
- * PRISON PCINT, from Charlestown to Cambridge.
- * West Boston bridge, from Boston to Cambridge.

4TH. — BRIDGES SUPPORTED BY RAILWAY CORPORATIONS.

1st. — Boston and Albany Railroad.

Harrison avenue.

MARKET STREET, Ward 19.

Tremont street.

Washington street.

2d. — Boston and Providence Railroad.

BEECH STREET, Ward 17.

BELLEVUE AVENUE, Ward 17.

BELLEVUE STREET “ “

CANTERBURY STREET, Ward 17.

Centre street or Hog bridge, Ward 15.

CENTRE AND MT. VERNON STREETS, Ward 17.

PARK AVENUE, Ward 17.

3d. — New York and New England Railroad.

Broadway.

Dorchester avenue.

Fifth street.

Fourth street.

Harvard street, Ward 16.

Madison “ “ “

Norfolk “ “ “

Norfolk “ “ “

Second street.

Silver street.

Sixth street.

Third street.

Washington street, Ward 16.

4th. — Old Colony Railroad.

Adams street.

Ashmont street and Dorchester avenue.

Commercial street.

Savin-hill avenue.

RECAPITULATION.

I. Number wholly supported by Boston	.	.	24
II. Number of which Boston supports the part within its limits	.	.	12
III. Number of which Boston pays a part of the cost of maintenance	.	.	5
IV. Number supported by Railway Corporations: —			
1. Boston and Albany	.	.	4
2. Boston and Providence	.	.	7
3. New York and New England	.	.	13
4. Old Colony	.	.	4
		—	28
		—	
Total number	.	.	69

I. — BRIDGES WHOLLY SUPPORTED BY BOSTON.

* ALBANY-STREET BRIDGE, (OVER ROXBURY CANAL).

This bridge was built in 1868 and 1869, at a cost of \$7,965.58, and was opened to travel early in the latter year. In 1872 it was thoroughly repaired, at a cost of \$1,692.80.

It is only 30 feet wide, and as the amount of travel over it is great, and since the wharf accommodation above it is insignificant, it should make way for solid filling of a width equal to that of the street. It is now in poor condition, but may be made to do service for a while longer by frequent repairs.

BERKELEY-STREET BRIDGE (OVER B. & A. R. R.).

Although of light proportions this structure appears to do its work without signs of dangerous yielding. The iron work beneath the flooring has been repainted and the bridge is now in good order.

BERKELEY-STREET BRIDGE (OVER B. & P. R. R.).

No change except that due to wear is noticeable in this bridge. The southerly abutment shows no signs of further movement.

The city will probably soon be required by the Boston and Providence Railroad corporation to build retaining walls on each side of Berkeley street, from the bridge to Stanhope street and Columbus avenue.

Plans and specifications were made for the retaining wall from the bridge to Stanhope street during the past year, and provision was made in the specifications for rebuilding the westerly corner of the abutment.

When these walls are built no trouble is anticipated from further movement of the abutment.

The remarks made in the last annual report about painting the iron work of this bridge will apply with equal force at the present time.

BROADWAY BRIDGE.

The remarks upon the fixed portions of this bridge, made in the last annual report, are still applicable.

The Phoenix columns should be at once protected, as they are made of $\frac{1}{4}$ -inch iron, which affords but a small margin for rust. The arch trusses over Lehigh and Foundry streets are badly distorted, but have been stayed by braces, and no change has been noticeable in the past year.

Early in the year the hot-air engines were removed, to make place for steam-engines of much greater power. These have worked very satisfactorily. They have sufficient

power to operate a capstan for pulling the vessels through the draw-way, and the gearing is so arranged that the capstan can be easily applied; before deciding upon its use, however, it was thought best to wait until experience with the one at Warren bridge had been obtained, and its value determined.

In the meanwhile careful surveys of the draw, made from time to time, showed it to be in such a condition that either very costly repairs must be made, both to the foundation pier and superstructure, or a new pier and draw must be built; accordingly a report to that effect (given in the Appendix), with a number of preliminary plans, was sent to the Committee on Bridges, and by them submitted to the City Council, with the recommendation that an entirely new structure be built, at an estimated cost of \$114,000.

An appropriation of that amount has been granted, and the work will be begun early in the spring.

The rest of the bridge requires repainting.

The amount expended under the direction of this department for alterations and repairs during the past year has been as follows:—

Engines, water-pipe, water-tank, etc.	\$5,020 68
Amount expended under other direction	2,264 17
Total	<hr/> \$7,284 85

BROOKLINE-AVENUE BRIDGE (OVER MUDDY RIVER, WARD 15).

This is a bridge of only 21 feet span, built by Joseph Ross, in 1871, at a cost of \$970. It replaced one built with round logs laid side by side and covered with gravel. It consists of 12 by 14-inch hard-pine stringers, placed three feet apart on centres, covered with 4-inch spruce and 2-inch oak planks, and resting on stone abutments. It is now in good condition.

CHARLES-RIVER BRIDGE (FROM BOSTON TO CHARLESTOWN).

This bridge is in charge of Commissioners who represent both cities, and for whom Mr. Wightman has acted as engineer. His report upon this and other bridges in the hands of commissioners will be found in the Appendix.

* CHELSEA-STREET BRIDGE (FROM EAST BOSTON TO CHELSEA).

In February and March, plans, specifications and estimates were made for rebuilding the Chelsea-street bridge with exception of the draw and its pier. Bids were advertised for, and a contract (dated June 2d) was made with Mr. Wm. A. Kenrick, of East Boston, who was the lowest bidder.

This work and some slight repairs on the draw and draw-pier were finished and the bridge opened to travel on August 1st.

The first structure at this place was built by the East Boston Co. in 1834, though the act of incorporation was granted to Benj. T. Reed and others as proprietors of Chelsea Free Bridge.

It cost \$8,277.76, and was opened to public travel in Oct., 1834. It was rebuilt by the company, in 1848, at a cost of \$4,678.15.

The act was so drawn that the proprietors of the bridge could close it to travel, which was accordingly done, and on May 6, 1850, the Mayor and Aldermen, by virtue of an act of the Legislature, laid out that portion of it which was within the limits of the city as a public highway. The dividing line between Boston and Chelsea is the harbor line on the Chelsea side.

The Chelsea side was laid out as a public highway 35 feet wide, by Commissioners appointed by the Court of Common Pleas, and in 1855, by order of the City Council, there were paid to the town of Chelsea \$8,473.00, on condition that said town would give a bond in the penal sum of \$10,000, to keep

that portion of the bridge and road in the limits of the town in good repair.

The bond was given July 12, 1855.

The Chelsea part of the bridge is built as a solid causeway, the abutment on that side being supposed to be on the harbor line. The first abutment that was built sunk, and another, founded on piles, was built around it. In 1868 the draw was rebuilt, and a new flooring to the bridge laid down by Mr. Joseph Ross, at a total cost of \$9,146.35.

The draw of the present structure is 22 feet wide, the fixed portion is 30 feet wide and 344 feet long, and is supported on 18 pile piers, each formed of 8 oak piles, well braced with oak braces. The piles are girder-capped with hard-pine sticks 7 by 14 inches, and support 12 by 14-inch hard-pine bolsters, on which rest the floor-stringers, 12 by 14, also of hard pine.

The floor-planks are 5 inches thick, of burnetized spruce, and are covered with a sheathing or roadway of 2-inch spruce planks, laid lengthwise of the bridge. On the north side of the bridge is a sidewalk 5 feet 6 inches wide, and on each side is a substantial railing of white pine, planed and painted.

About 140 feet in length of the old bridge, on the East Boston side, has been replaced by solid filling, held in place on the west side by a heavy dry rubble retaining-wall, and on the south end, which is 36 feet back from the Harbor Commissioners' line, by a stone abutment of like construction. The width at the top of this part is 31 feet, one foot in width of the wall and its batter (which is one inch in a foot) and projection of its footing courses being on the land of the East Boston Company. This company has given a proper release for the land occupied, conditioned on its being allowed to make use of so much of the wall as is on its land, for building upon.

The wall is capped with a line of granite stones, 18 by 18

inches, laid in cement, and supporting iron standards for a wooden railing. The total cost of the bridge, including engineering expenses, was \$17,260.27.

COLUMBUS-AVENUE BRIDGE (OVER B. & A. R. R.).

This bridge is in good condition. The grade has been raised in the centre to drain the roadway, the roadway replanked, and the iron-work below the flooring repainted during the past year. The cost of these improvements, not including the painting, was \$1,663.94.

COMMERCIAL POINT OR TENEAN BRIDGE, WARD 16.

In 1871 about 130 feet of the pile work at the southerly end of this bridge was replaced by a solid causeway, and now the bridge, properly so-called, consists of little else than a draw. This is not in condition to require any very expensive repairs, still it will, unquestionably, require to be replaced by a new one in a short time.

DARTMOUTH STREET (OVER B. & A. AND B. & P. R. R.'s).

This bridge was built in 1869. It consists of wooden trusses (built in the style known as the Pratt truss), in three spans and continuous over the piers. The piers and abutments are formed of heavy trestle-work, supported on oak piles. Great care was taken in its construction to secure good material and workmanship.

During the past season the superstructure began to show signs of weakness.

The vibration caused by a passing team, especially if moving at a brisk trot, was unusually great. This defect was attributed to the unequal settling of the piers and abutments, which caused strains within the continuous upper chords they were not proportioned to resist, and which changed the character and amount of strain in some of the ties and counters.

The upper road planking requiring to be repaired, it was decided by the Committee on Paving to have the bridge thoroughly overhauled, and accordingly this work was begun; but, upon removing the ornamental casing and sheathing of the trusses, it was found the lower chords were in a dangerous state of decay, the lower portions of the posts in an even worse condition, and the upper chords also somewhat rotten.

The ends of the floor timbers, where they rested upon the trusses, were badly decayed, and the three thicknesses of floor planks were in a condition to require the removal of all but about one-half of the lower course, which had been creosoted by the Robbins process.

Considering that the bridge had been erected but four years, this state of things was quite surprising.

This being reported to the committee, orders were given to stop repairs, and to make estimates for a new bridge in one span, with iron superstructure and stone abutments. Such an estimate, amounting to \$155,000, was made, and by the committee presented to the City Council, with the recommendation that an appropriation for this amount should be granted.

The appropriation was not passed, however, but instead repairs were ordered, at an estimated expense of \$3,000.

The bridge was at once closed to travel and the repairs began, and are now (January 26, 1874) completed.

The floor planking, of which there were three thicknesses, nine inches thick in all, has been (all but about one-half the lower course) replaced by two courses of new lumber, giving a total thickness of five inches. Some four or five new posts have been inserted and others strengthened by side pieces nailed on, and the trusses on each side of the two longer spans have been reinforced with new trusses of the bowstring form, with a wooden bow and iron tie. The new trusses are proportioned to bear the entire moving load, and are connected with the old ones by iron suspending-rods

attached to stirrups on which rest the lower chords, — there being a bowstring on either side of each of the old trusses.

The bills for this work have not yet been presented. The bridge can be kept in service probably a year or two longer, but will require careful watching.

DORCHESTER-STREET BRIDGE (OVER O. C. R. R.).

This structure is in a serviceable condition, and will require only ordinary repairs.

*DOVER-STREET BRIDGE (OVER FORT POINT CHANNEL).

This bridge has been examined and repaired from time to time during the season, and in November last was thoroughly surveyed by Mr. Manley, who then reported upon its condition. (See Appendix for report.) It being too late in the season to make the thorough renewals there marked out, it was recommended that repairs be made, at a cost not exceeding \$1,800. The repairs indicated in the latter part of Mr. Manley's report have been made, and the bridge is now safe, but is in a condition where further repairs of the upper works will soon become more costly than reconstruction.

The bridge should be widened, and a draw that can be handled much more quickly should be substituted for the existing one, that the great travel which daily passes over may be properly accommodated.

The amount expended under the direction of this department	
for repairs has been	\$2,741 73
Amount expended under other direction	467 42
<hr/>	
Total,	\$3,209 15

*FEDERAL-STREET BRIDGE (OVER FORT POINT CHANNEL).

The work of widening and rebuilding this structure, as described in the last annual report, was finished early in the year.

The draw is a slide draw, in two parts, which are drawn off in opposite directions. Each part weighs about seventy-five tons, and moves about forty-four feet to leave a clear channel, yet runs so easily that the movement can be made by a horse in less than thirty seconds.

The total cost of the work, including extras and engineering expenses, was \$90,032.24.

The bridge is now in good condition and will require no repairs this season, other than those due to wear and accident.

The amount expended under the direction of this department for repairs for the past year, including the cost of a new buoy, has been \$1,400 95

FERDINAND-STREET BRIDGE (OVER B. & A. R. R.).

This is an iron bridge, of light construction. The floor beams have not sufficient depth to give proper stiffness, and are not properly connected with the trusses. It has, however, done its work without showing signs of failure, and now needs no special repairs. The iron work of the trusses should be repainted soon.

The cost of repairs for the past year, made under the direction of the Paving Department, has been \$94.15.

HUNTINGTON-AVENUE BRIDGE (OVER B. & A. R. R.).

Nothing has been done to this structure since the date of the last report, nor indeed since it was built. Since the time of the Peace Jubilee it has not been used as a bridge for common travel, but, with the consent of the Committee on

Streets, has served to carry the railroad track of the contractor for filling Back Bay lands. It is now in very much the same state as described a year ago, and it is still questionable as to what should be done to place it in proper condition.

Measurements have been taken at various times during the year to ascertain the amount and direction of the movements occurring in the abutments. These movements, although diminishing in rate, still continue. Between Jan. 17th and Oct. 3d, the northerly abutment had moved one-tenth of a foot and the southerly abutment nineteen-hundredths of a foot, or over $2\frac{1}{4}$ inches.

The total movement since the completion of the bridge has been, for the northerly abutment 9 inches, and for the southerly abutment $13\frac{3}{4}$ inches. Before the bridge comes into much use as a public highway it should receive extensive repairs.

*MERIDIAN-STREET BRIDGE (FROM EAST BOSTON TO CHELSEA).

In May last, the draw, with its running gear and pier, received very thorough repairs. In July, Mr. Manley made a detailed examination of the draw, and submitted a special report upon its condition (see Appendix), which was transmitted, with recommendations, to the Committee on Bridges.

The bridge is in good condition, with the exception of the concrete sidewalk (which should be relaid) and the planking of the draw. Orders have been given for replanking, but the work is not yet done.

The cost of repairs done under the direction of this department during the past year was	.	.	\$1,525	21
Of those done under other direction	.	.	154	23
Total	.	.	.	\$1,679 44

MILLDAM BRIDGE (OVER BACK BAY SLICES).

This structure is in good condition, and will require nothing but ordinary repairs during the coming year.

*MT. WASHINGTON-AVENUE BRIDGE (OVER FORT POINT CHANNEL).

This bridge is now in good condition. During the year it has been repaired by replanking the draw, and improved by changing the lines of the sidewalks near the draw, putting up new gates with iron posts, painting the draw and patching the fence.

The cost of repairs made under the direction of this department has been	.	.	.	\$1,496 72
The cost of other repairs has been	.	.	.	1,341 59
Total	.	.	.	<u>\$2,838 31</u>

NEWTON-STREET BRIDGE (OVER B. & P. R. R.)

This bridge is not much used, and although it has received no repairs is in good condition, with, of course, the exception of the northerly abutment, which is badly cracked by the movement of its foundation.

PUBLIC GARDEN FOOT BRIDGE.

This structure is in good condition.

SHAWMUT-AVENUE BRIDGE (OVER B. & A. R. R.).

This bridge is in good order with the exception of the paint. It should be repainted the coming year.

*WARREN BRIDGE (FROM BOSTON TO CHARLESTOWN).

This bridge is in the charge of Commissioners. A statement of its present condition, and the renewals required for the coming year, will be found in Mr. Wightman's report in the Appendix.

WINTHROP BRIDGE (FROM BREED'S ISLAND TO WINTHROP).

Portions of the floor planking of this bridge have decayed and will require to be replaced soon. Otherwise it is in fair condition.

II. BRIDGES OF WHICH BOSTON SUPPORTS THE PART WITHIN ITS LIMITS.

The maintenance of most of the bridges classed under this head has been lately thrown upon the city, through the annexation of Charlestown, West Roxbury and Brighton, and they have not yet received from this department that careful examination which is required for a full and positive statement of their condition.

*CAMBRIDGE-STREET BRIDGE (FROM BRIGHTON TO CAMBRIDGE).

This is a pile bridge, with a leaf draw, the centre of which is on the division line between Brighton and Cambridge. The part within the limits of Boston has been repaired lately and is in good condition.

*CHELSEA BRIDGE (FROM CHARLESTOWN TO CHELSEA.)

This bridge is 3,633 feet long and 32 feet wide, and is provided with two draws, one in Charlestown, the other in Chelsea.

Of this length Charlestown has supported 2,333 feet, the Lynn and Boston horse-railway corporation, however, planking one-half the width and furnishing the two lines of stringers which carry its track.

It is very old and in a dangerous state. It probably will have to be rebuilt at an early day. When rebuilding, from 1,200 to 1,500 feet of it can be replaced by solid filling without the expense of retaining walls, and can be widened to

about 64 feet without purchase of more land, as the bridge corporation which built the original structure owned a strip of land of that width, the centre line of the bridge being on the centre line of the land.

*GRANITE BRIDGE (FROM DORCHESTER TO MILTON).

This bridge is in fair condition, and will require only ordinary repairs.

LONGWOOD-AVE. BRIDGE (FROM WARD 15 TO BROOKLINE).

This bridge has been examined lately and found to be in very bad condition. The report of Mr. Manley in the Appendix will give the detail of repairs required, with an estimate of their cost.

A permanent structure should be built to replace the present bridge, but as Brookline and Boston are jointly interested, it will probably take considerable time to devise a plan which will be mutually satisfactory. I should, therefore, recommend the repairs mentioned in Mr. Manley's report to be made.

MATTAPAN BRIDGE (FROM WARD 16 TO QUINCY).

MILTON BRIDGE " " " " "

These bridges are in good condition.

*NEPONSET BRIDGE (FROM WARD 16 TO QUINCY).

The Committee on Bridges, at the beginning of the year, decided to recommend the rebuilding of that portion of this structure supported by Boston, and requested plans and estimates prepared for the consideration of the City Council.

Surveys were made in February, and the plans were partially completed by Mr. Learned, when it became necessary to withdraw him from this work to commence upon other more urgent, and his duties since have prevented his again

taking hold of the plans until near the close of the year. They will soon be finished, and, with estimates, presented to the committee.

The bridge was repaired at an expense of \$980.64.

***NORTH BEACON-STREET BRIDGE (FROM WARD 19 TO WATERTOWN).**

This bridge has been recently renewed above the pile caps and is in good order.

***NORTH HARVARD-STREET BRIDGE (FROM WARD 19 TO CAMBRIDGE).**

This bridge is in good order, though the draw (which is new) needs more counter-balance. The draw pier should be replanked, and the dolphin, used by vessels in passing through, which has been carried away, should be replaced as soon as navigation begins.

SPRING-STREET BRIDGE (FROM WARD 17 TO DEDHAM).

This is a five-arch stone bridge over Charles river, connecting Ward 17 with Dedham. It is in good condition, and with the exception of the fence, which will soon have to be renewed, requires no repairs. One half of the bridge will in future be supported by Boston.

***WESTERN-AVENUE BRIDGE (FROM WARD 19 TO CAMBRIDGE).**

One of the piles of this bridge is badly shattered at the top, and must be replaced in the spring. (It has been temporarily strengthened within a few days.) The draw pier needs to be replanked, and very likely new floor timbers will be required.

*WESTERN-AVENUE BRIDGE (FROM WARD 19 TO WATERTOWN).

This bridge is apparently in fair condition ; the draw pier, however, will require thorough repairs.

A petition was sent to the Harbor Commissioners, a short time since, requesting an alteration of the position of the draw, which is badly located for the passage of vessels going above the bridge. No action was taken by the commission, but when the draw is rebuilt, in view of the location of the Brighton abattoir, and the business which will ultimately concentrate above the bridge, it would be good policy to alter its position.

III. BRIDGES OF WHICH BOSTON PAYS A PART OF THE COST OF MAINTENANCE.

ALBANY-STREET BRIDGE (OVER B. & A. R. R.).

The existing structure is soon to be removed, to make place for one of longer span, and, as the change is for the accommodation of the Boston & Albany Railroad, that corporation will make the improvement at its own expense.

The abutments have moved, and are badly cracked. They may be said to be in very poor condition, and when the bridge is rebuilt they should be taken down and built anew.

*CANAL BRIDGE (FROM BOSTON TO CAMBRIDGE).

This bridge is in the charge of commissioners. Mr. Wightman's report will give the requisite information relative to its condition and the proposed improvements.

*MALDEN BRIDGE (FROM CHARLESTOWN TO EVERETT).

This bridge has not been closely examined, but will receive careful inspection as soon as the weather will permit. It is quite old, and undoubtedly is in an unsafe condition.

It has a counter-balanced turn-table draw, which is nearly new, and in good order.

Although entirely within the limits of Charlestown, it is supported by the several towns, corporations, etc., benefited by it, as provided in chapter 266 of the Acts of 1869.

By this act the County Commissioners of Middlesex county are required to assess annually the various corporations interested in the maintenance of the bridge, for the estimated cost of maintaining it for the year, and they are also requested to designate who shall receive and disburse the money. It is directed that the Mayor and Aldermen of the city of Charlestown shall have the care and superintendence of the bridge, and that said city shall be liable for any loss or injury that any person may sustain by reason of carelessness or misconduct of its agents in the management of the bridge.

*PRISON POINT BRIDGE (FROM CHARLESTOWN TO CAMBRIDGE).

This is an old and poor structure, too narrow for convenient use, consisting of little else than a draw.

Chapter 300 of the Acts of 1870 requires the cities of Charlestown and Cambridge to forthwith construct a new draw, and directs each city to choose a commissioner to have the care and management of the bridge, the expense to be borne equally by the two cities. No commissioners have been chosen under this act, but since its date, the draw has been rebuilt; in fact, all the draws between this and the harbor have been rebuilt or changed in conformity to a general plan of the Harbor Commissioners, regulating their position, and the direction and width of draw openings.

It would seem proper that this bridge should now be placed under the charge of the commissioners on West Boston and Canal bridges.

***WEST BOSTON BRIDGE (FROM BOSTON TO CAMBRIDGE).**

This bridge is under the charge of commissioners appointed, one from each city. Mr. Wightman's report will give full information in regard to it.

IV. BRIDGES SUPPORTED BY RAILWAY CORPORATIONS.

With the exception of certain bridges described in the report of Mr. Manley, on the Hartford & Erie (New York and New England) bridges (see Appendix), all the structures that are classed under this head are either in good or fair condition, and will require no special mention at this time.

MISCELLANEOUS CONSTRUCTIONS AND ESTIMATES IN 1872.

Under this head may be classed : —

Berkeley-street Retaining Wall. — Plans and specifications have been made for a retaining wall on Berkeley street, from the bridge over the Boston & Providence Railroad, to Stanhope street, on the westerly side. The specifications were printed, but the work has not yet been advertised for proposals, the Superintendent of Streets preferring to wait until the coming season.

Chester Park Extension Bridges. — Plans for the bridges, with their abutments, which will be required for crossing the Boston and Providence and Boston and Albany Railroads, on the extension of West Chester Park, have been prepared.

If the filling of the avenue is completed, in accordance with the contract with Mr. Munson, the city will probably be called upon to build them during the coming year.

Eastern-avenue Extension. — Considerable work has been done, by this department, in locating lines, making plans, and taking soundings and borings for this extension.

The construction of the bridge will have to be commenced in the spring, the terms of the contract between the State and the city requiring its completion during the year 1874. An appropriation has been made by the City Council which will partially cover the cost of this improvement, and the plans of the bridge and sea-walls are now in progress.

Lovejoy's Wharf. — The retaining wall on the easterly side of Beverly street, adjoining Lovejoy's Wharf, having moved to such an extent as to narrow the dock, the Superintendent of Streets requested this department to prepare plans for remedying the difficulty.

Plans for cross-bracing the piers of the wharf were made, and the work was satisfactorily completed by Messrs. Whitcomb and Potter, for the sum of \$450.

Pinckney-street Sea Wall. — The rebuilding of this wall, which was commenced in the fall of 1872, was not completed until June, 1873. The work has been thoroughly done, and no signs of movement have been observed. The contract price was \$6,850.

Pyncheon-street Retaining Wall. — In May plans and specifications were made for a retaining wall on the northerly side of Pyncheon, at its junction with Washington street. The wall was about 431 feet long, of an average height of 17 feet, and to be built of Roxbury stone, with granite capping. Proposals were advertised for July 2, and the contract awarded to Thomas Dolan, for \$9,548. The wall has been substantially built, under the supervision of an inspector (Mr. J. W. Coburn), and was completed on the 3d of December. A continuation of the wall, not required by the contract, was built by the same contractor for \$489.09.

Summer-street, East Boston Bridges. — Plans and estimates for a bridge for team and foot travel, over the Eastern

Railroad, on Sumner street, were made in March, and in December plans and estimates for a foot-bridge on the same location were made, but neither have as yet been adopted.

Respectfully submitted,

JOS. P. DAVIS,
City Engineer.

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